
# Network Middleware for Next-Generation Network Computing

Martin Swany


# Introduction and Motivation

- Phoebus is another name for the mythical Apollo in his role as the “sun god”
- The DOE UltraScienceNet is a tremendous resource
- Our goal is to work with DOE collaborators to help extend its reach and impact
  - While exploring protocols and system software to aid Science applications
- Novel research environments require sweeping changes to systems
  - As well as research to foster community understanding

Phoebus

# Approach

- Allow legacy applications to use UltraScienceNet via various adaptation mechanisms and adapter subsystems
  - Embrace the heterogeneity of end-to-end network environments
- Adaptation
  - Middleware Software Layers
  - Protocols
  - Prototype Platforms

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# Signaling Adaptation

- The world consists of domains with various signaling disciplines and protocols
- We need to map between different administrative domains and protocols
  - Meta-scheduling among multiple resource brokers and multi-phase signaling
- Algorithms to assemble and optimize composite paths
  - Even in a single administrative domain, this is complex

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# Reservation Adaptation

- Resource reservation of network resources is only part of the picture for large-scale computing and data movement scenarios
- Emerging Grid-related technologies like WS-Agreement give a rich language to speak about reservations
- Advance co-allocation of networks, storage and compute resources
- Grid/Web Service interfaces to brokers

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# Transport Adaptation

- The appropriate transport protocol may depend on the particular network
  - Type and instance
- When networks are not homogeneous, a single transport protocol may not be appropriate
  - End to end connectivity doesn't necessarily mean E2E flow control at the packet level
- Establish an E2E "session"
  - Based on the Logistical Session Layer (SC'04)

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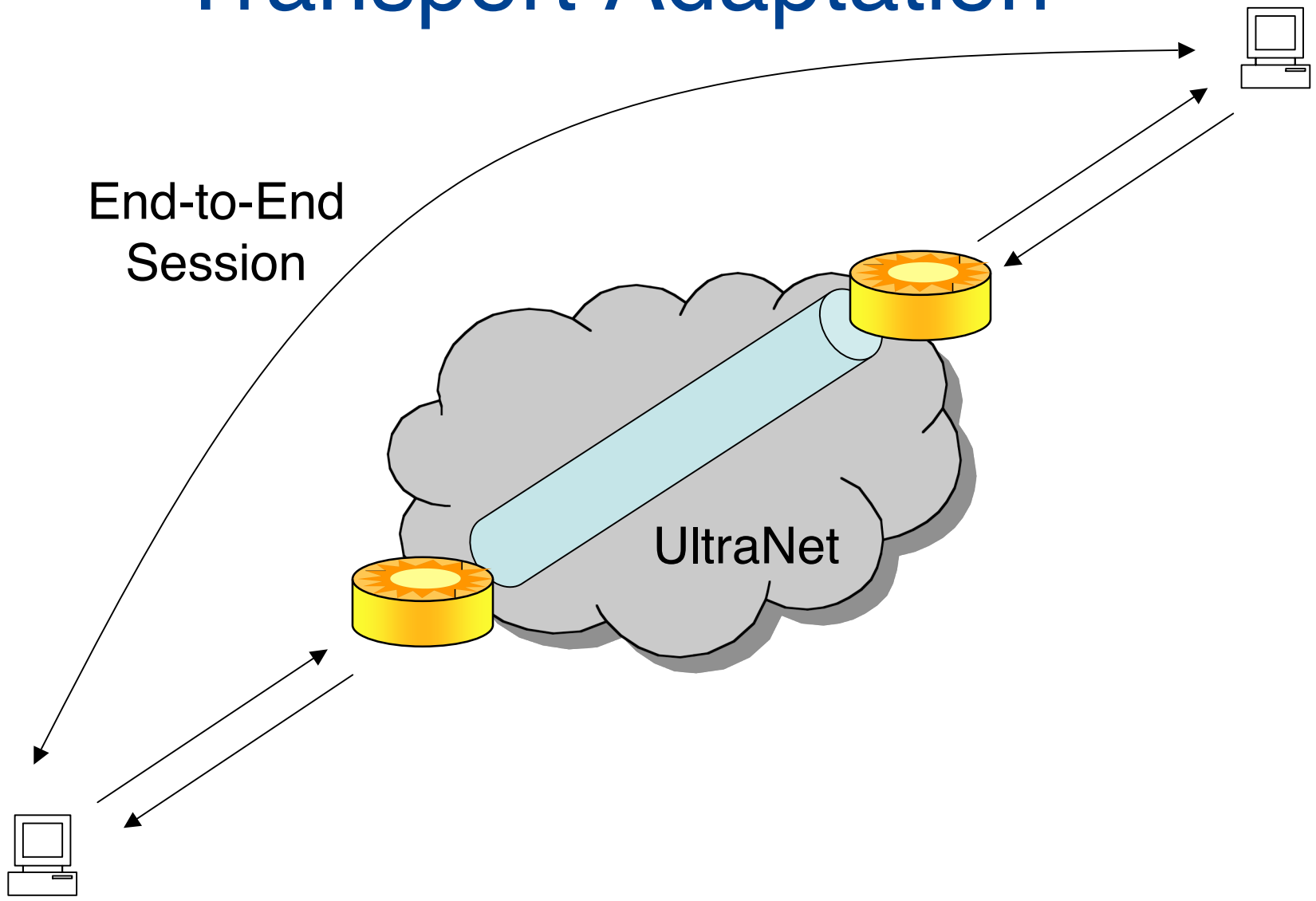
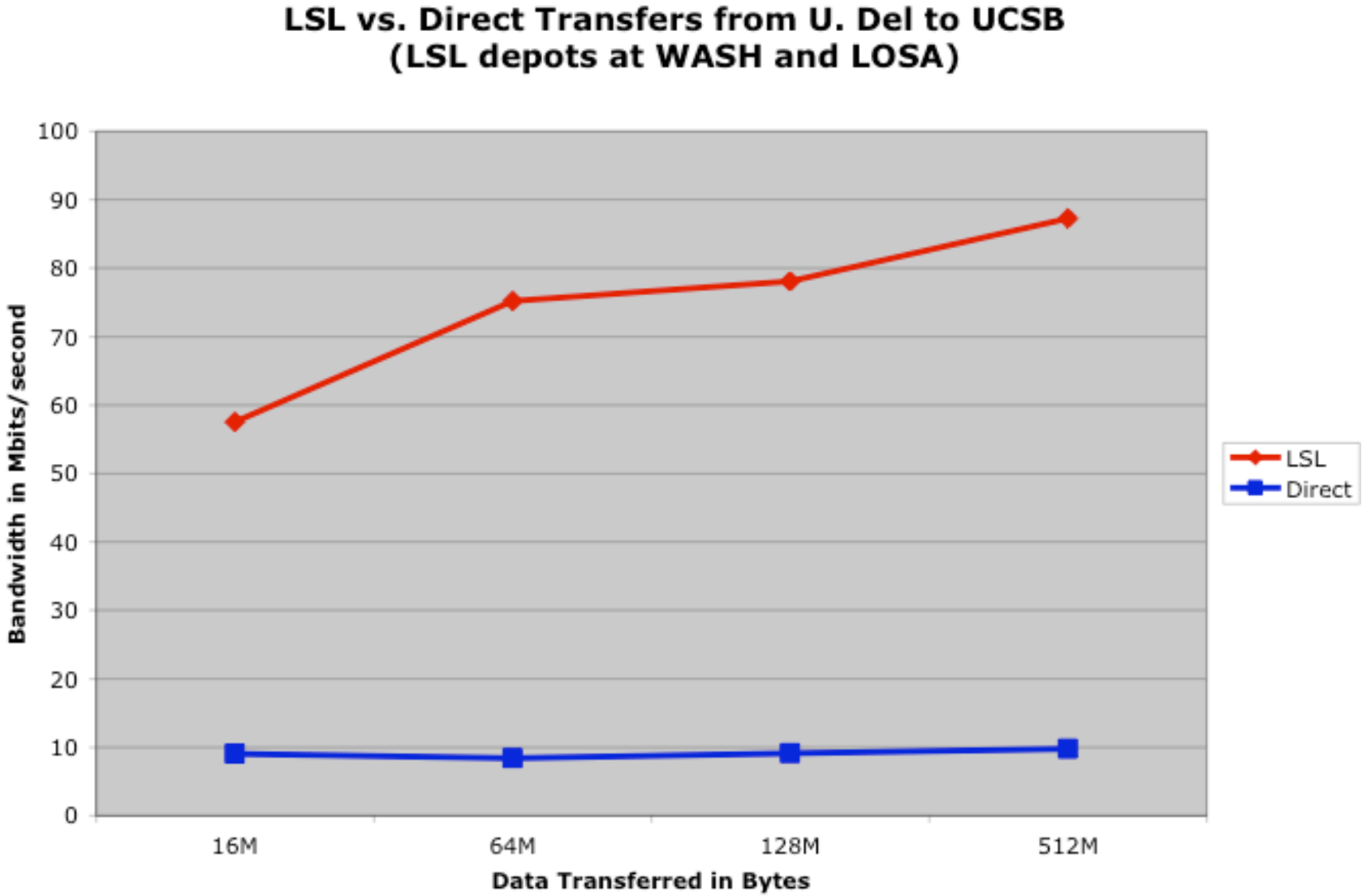
# Transport Adaptation



# Transport Adaptation

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# Approach and Technology

- Middleware and protocols for end systems
  - Software libraries to enable applications
- Network Service Middleware
- Network-processor based implementation of Transport adaptation
  - Intel IXP based platforms can sustain line rate
  - This development is underway
- Transparent adapter for LSL
  - Unix binaries can be enabled at runtime

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# Conclusion

- Ultimate integration of various components helps realize the goal of agile, extreme performance networking
- Automatic scheduling and resource allocation can drive down resource acquisition time and drive up utilization
- Composition of various signaling and transport domains in single unifying framework
  - Not as an ad-hoc assemblage, but as a new architectural model

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